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NOTES FOR STUDENTS.

THE "PROTEID VACUOLES" of gymnosperms have recently been reinvestigated by Arnoldi.[3] These structures were described by Hofmeister nearly fifty years ago as "Keimbläschen" (germinal vesicles) and he makes the statement that the archegonium of the vascular cryptogams differs from that of the gymnosperms in having only one nucleus (Keimbläschen) while that of the gymnosperms has many. Schacht, who wrote at about the same time, regarded the structures as cell-sap vacuoles, while Strasburger, at a considerably later period, regarded them as proteid vacuoles.

Goroschankin (1883), who made some study of their development, found that they differ from the sap vacuoles, and make their appearance before the cutting off of the ventral canal cell, disappearing during the formation of the embryo.

The present writer, with the aid of modern technique, has attacked the old problem of the origin and development of the bodies and finds that they are genuine nuclei. The nuclei of the cells of the tapetal layer immediately surrounding the oosphere put out amoeboid processes which penetrate the cell wall, and soon the whole nucleus passes through the opening and into the cytoplasm of the egg, where they become more or less modified so that while they bear a striking resemblance to nuclei they could not be positively identified as such except by tracing them back to their origin. Nuclei were also observed to pass from the next layer into the cells of the tapetal layer. The paper is only a preliminary one, but the stages figured are strong evidence in favor of the author's view. These bodies serve only for the nutrition of the embryo and take no part morphologically in its development.—CHAS. J. CHAMBERLAIN.

DUNCAN S. JOHNSON has been investigating *Saururus cernuus*[4] in reference to the claim made by Engler and others that it is a primitive dicotyledonous type. He finds in the developing ovule a one-celled archesporium; a "tapetal" cell is cut off, which gives rise to but few cells; the megaspore mother cell organizes a row of three, the lowest of which becomes the functioning megaspore; the ante-fertilization development of the sac structures is as usual; the antipodal cells are evanescent. After the ante-fertilization stage is reached the sac grows rapidly, especially in length, and finally broadens below, remaining narrow at the top, thus appearing as a long-necked flask, with the primary endosperm nucleus lying at the base of the neck. At the first division of this nucleus one daughter nucleus remains in the neck, the other moves down into the body of the flask, and a wall is formed across the base of the neck, giving rise to two endosperm chambers. The upper endosperm nucleus divides and forms a compact tissue in the upper chamber; while the other enlarges but never divides, the lower and larger endosperm chamber apparently being related to the adjacent perisperm as an absorbing organ. In the upper chamber the embryo is organized, and the endosperm about it encroaches upon all the nucellar tissue adjacent to it.

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[3] ARNOLDI, W.: Beiträge zur Morphologie der Gymnospermen. IV. Was sind die "Keimbläschen" oder "Hofmeister's Körperchen" in der Eizelle der Abietineen? Flora **87**: 194–204. *pl. 6, 7.* 1900.

[4] On the development of *Saururus cernuus* L. Bull. Torr. Bot. Club **27**: 365–372. *pl. 23.* 1900.

The germination of the seed is also very peculiar, the endosperm emerging first, and retaining hold of the cotyledons and supplying nutrition after the cotyledon tips have carried the old seed well up into the air. The author concludes that there is no evidence that Saururus is more primitive in character than many other dicotyledons.— J. M. C.

FR. SCHAIBLE has devised an apparatus for research on the effect of diminished air pressure on plant growth,[5] in which the plants can be cultivated for a considerable time without being in a stagnant atmosphere and without being subjected to repeated evacuation of the culture chamber. The essential feature is the use of a tubulated bell jar to which air is admitted through a capillary tube, a water pump in continuous operation serving to exhaust the chamber more rapidly than the air can enter through the capillary passage.

He finds, in agreement with Wieler and Jaccard, that ordinary growth is accelerated, especially that of the leaves, while germination is retarded and is of lower percentage. Investigation of the question whether these results are due to diminished pressure, as such, or to diminished partial pressure of oxygen, leads Schaible to conclude that the retardation of germination is due to the diminished O pressure. The acceleration of growth, however, is not due to this cause (which really tends to retard growth slightly), nor to lessened CO_2 pressure, nor to the altered light, heat, or moisture. The only possible explanation seems to be that the plants absorb water more rapidly under the lower pressure (isolated cylinders of live plth do so), and consequently the cells reach their definitive size more quickly, thus attaining earlier the stage of division. The copious guttation observed both by Döbereiner and Schaible also accords with this explanation.—C. R. B.

ITEMS OF TAXONOMIC INTEREST are as follows: A. ENGLER (Bot. Jahrb, **28**: 385–510. 1900) has completed his account of the flora of the Lake Nyassa region, describing numerous new species. *Neogoetzea* Pax (Euphorbiaceæ), *Linnaeopsis* Engler (Gesneriaceæ), *Megalopus* K. Schumann (Rubiaceæ), and *Ageratina* C. Hoffmann (Compositæ), are the new genera.— HENRY DEANE and J. H. MAIDEN are publishing in Proc. Linn. Soc. of South Wales a series of papers entitled "Observations on the eucalypts of New South Wales." The last one issued (Proc. Linn. Soc. **4** : 612–630. *pls. 48–50.* 1900) is the sixth, and includes descriptions of three new species.— E. P. BICKNELL (Bull. Torr. Bot. Club **27** : 373–387. 1900), in continuing his "Studies in Sisyrinchium," has revived Salisbury's genus *Hydastylus* to receive the yellow-flowered *S. Californicum*, and has associated with it 11 other species, 9 of which are described as new.— K. M. WIEGAND (*ibid.* 388–391) has described two new species of *Saxifraga* and one of *Primula* from the northwest.—C. V. PIPER (*ibid.* 392–401), in continuing his "New and noteworthy northwestern plants," describes new species of *Amelanchier, Potentilla, Saxifraga* (3), *Townsendia, Erigeron, Castilleia* (2), and *Salix* (2).— KATHARINE BRANDEGEE (Zoe **5** : 31–35. 1900), in her third paper entitled "Notes on Cacteæ," describes two new species of Mamillaria, besides giving critical notes on several other forms.— C. WARNSTORF (Hedwigia **39** : 100. 1900) has described four new Sphagna from Virginia and North Carolina collected by T. H. Kearney.—J. M. C.

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[5] Fünfstuck's Beitr. z. wiss. Bot. **4**: 93–148. 1900. See also Bot. Centralbl. **82**: 52. 1900.

MR. HAROLD WAGER has published the results of his study of the fertilization of *Peronspora parasitica*,[6] his conclusions being as follows : the protoplasm of the oogonium differentiates as usual into vacuolate ooplasm and granular periplasm ; a receptive papilla is formed on the oogonium in contact with the antheridium and is penetrated by the antheridial tube ; the nuclei of the oogonium and antheridium undergo mitosis before fertilization ; soon after the delimitation of the oosphere the central body appears, which seems to play some part in bringing the sexual nuclei together ; a single nucleus from the periplasm travels towards the central body, coming in close contact with it, and towards it the antheridial tube advances and discharges a single nucleus ; fusion occurs while the nuclei are in the resting stage and not until the oospore is nearly ripe; the central body disappears before fusion ; the ripe oospore is uninucleate ; no difference is observable between the sexual nucleus and those that remain in the periplasm, all probably being potentially sexual; three types of fertilization and oospore-formation in the Peronosporeæ may be distinguished, as follows: (1) uninucleate oosphere, binuclear fusion, and uninucleate oospore (*P. parasitica*); (2) uninucleate oosphere, binuclear fusion, and multinucleate oospore (*C. candidus, C. Portulacae*, and *P. Ficariae*); (3) multinucleate oosphere, multinuclear fusion in pairs, and multinucleate oospore (*C. Bliti*).— J. M. C.

A PRELIMINARY paper by Lidforss[7] records some interesting experiments upon the chemotropism of the pollen tube. *Narcissus Tazetta* furnished material for most of the work.

If the pollen be placed in a 5–15 per cent. sugar-gelatin solution and a piece of stigma be added, the pollen tubes soon turn toward the stigma, as is already known. Lidforss finds that organic acids, formic, acetic, succinic, lactic, tartaric, malic, etc., as well as amides, glucosides, and tannins, do not produce any undoubted effect upon the direction of growth of the tubes. Diastase, however, produces an almost immediate effect, and experiments show that it is the proteid constituent of the diastase which attracts the pollen tube. Further experiments show that carbohydrates and proteids are the substances which influence the direction of growth and indicate that the movement of the pollen tubes is for the purpose of securing nutrition.

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[6] Annals of Botany **14** : 263–279. *pl. 16.* 1900.

[7] LIDFORSS, B.: Ueber den Chemotropismus der Pollenschläuche. (Vorläufige Mittheilung.) Ber. d. deutsch. bot. Gesell. **17** : 236–242. 1898.

The pollen of most Liliaceæ is more sensitive to mineral salts than Narcissus pollen, the same diastase preparation which attracts Narcissus pollen quickly killing the pollen of Fritillaria, but if the salts be dialyzed out the proteid exerts a strong influence upon Fritillaria pollen.—CHAS. J. CHAMBERLAIN.

IN AN ADDRESS before the Niederrheinische Gesellschaft für Natur und Heilkunde zu Bonn,[8] Dr. F. Noll[9] makes a suggestion which is likely to prove fruitful, because it not only groups together some previously isolated facts, but seems likely to be the starting point of further investigations. He has been led to believe that the *form* of the plant body itself is a source of both orienting and formative stimuli. As evidence of this he appeals to the fact that in regions of curvature the concave side of roots remains entirely free of lateral rootlets, which are limited to the convex side; or, if they appear at all upon the neutral flanks, they bend more or less sharply toward the convex side. These phenomena have been observed in all the plants studied, including representatives of all the great groups which develop roots.

With these facts Noll correlates Wiesner's "exotrophy," a widespread phenomenon, whereby the growth of external members or their external flanks is conspicuously promoted as compared with that of corresponding members situated toward the interior. Vöchting's "rectipetality," Pfeffer's "autotropism," and the phenomena of replacement, regeneration, and polarity have a new light cast upon them by Noll's suggestion. Many old fields also need exploring from this new point of departure.—C. R. B.

THE DISCOVERY by A. C. Hill that the hydrolysis of maltose by maltase is a reversible process and that this enzyme is also capable of forming maltose from glucose[10] seems to be supported by the results of M. Cremer's nvestigations.[11] He finds that the glycogen-free expressed extract of yeast is capable of producing glycogen in a 30 per cent. solution of fructose, which is

[8] Sep. Abdr. aus d. Sitzungsber. d. Niederrhein.. Gesells. 1900; Sitzung von Jan. 15. 1900. pp. 6.

[9] Noll's extended researches are announced to be published in Thiel's Landwirthschaftliche Jahrbücher early in this year.

[10] Trans. Chemical Soc. **1898**: 634–658.

[11] Berichte d. deutsch. chem. Gesells. **1899**: 2062–2064.

a still more complex process than the production of maltose from glucose. Meyer suggests[12] that similar relations may exist among other polysaccharides which are hydrolyzed by enzymes. Holding that the enzyme which digests starch has its origin in the plastids,[13] he now thinks it probable that this enzyme acts like maltase. When a concentrated solution of sugar enters the stroma from the cytoplasm, amylose is formed, which on reaching a certain concentration crystallizes out in the form of a starch grain; while if sugar is wanting in the cell a relatively active inversion of amylose occurs, and a rapid solution of the starch grains. The suggestion is interesting and deserves careful testing.—C. R. B.

MR. W. H. LANG has published the second number[14] of his series entitled "Studies in the development and morphology of cycadean sporangia," dealing with the ovule of *Stangeria paradoxa*. His results are as follows: two ovules are developed on each sporophyll; the archesporium consists of a mass of cells, one of which is selected, enlarges very much, and forms a row of three, the lowest cell of which organizes the megaspore; at the time of pollination the sac is full of endosperm (but without archegonia), the pollen chamber is fully developed within the beak-like process of the nucellus, but the breaking down of nucellar tissue between the pollen chamber and the embryo-sac has not begun; as in Cycas and Zamia, the sperms are large, spirally twisted, and multiciliate, with the blepharoplast band evident; disorganization of endosperm tissue between the pollen-chamber and the embryo-sac gives free access to the latter, and the sperms are discharged into the archegonial chamber of the nucellus, reaching the neck by swimming.— J. M. C.

HUGO DE VRIES has been experimenting in hybridizing the races of maize,[15] producing the well-known phenomenon of xenia. Associating his results with those of Nawaschin and Guignard, who have announced the discovery of double fertilization in the embryo-sac of certain liliaceous plants, he has reached the conclusion that the hybridization of the embryo is always accompanied by the hybridization of the endosperm, and that this phenomenon can only be explained by double fertilization. He found that every grain whose endosperm showed the characters of the pollinating parent had a hybrid embryo; and that every grain whose endosperm showed the characters of the embryo-sac parent had an embryo of pure race, and was therefore self-fertilized. In a few words he puts it that double fertilization is corroborated by double hybridization.— J. M. C.

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[12] Bot. Zeit. **57**^{2}: 313. 1899.

[13] Untersuch. über Starkekörner 169.

[14] Annals of Botany **14**: 281–306. *pls. 17–18.* 1900.

[15] Sur la fécondation hybride de l'endosperme chez le maïs. Rev. gén. de Botanique **12**: 129–137. *pl. 15.* 1900.

GEORGE MASSEE, in discussing the origin of the Basidiomycetes,[16] presents the following summary: (1) in the conidial condition certain ascigerous fungi bear their spores on structures morphologically indistinguishable from the basidia of the Protobasidiomycetes; (2) some members of the same form genera as those described in (1), as *Stilbum vulgare* Tode, have lost the ascigerous condition from their life cycle, and are accepted as true Protobasidiomycetes; hence we are justified in concluding that the Protobasidiomycetes as a group originated from ancestors that represented the conidial condition of ascigerous fungi; (3) there is no evidence in favor of the suggestion that the Autobasidiomycetes are descended from the Protobasidiomycetes; on the other hand, the evidence in favor of the Autobasidiomycetes having been derived by gradual modification of the spore-bearing organs, or basidia of conidial forms of certain ascigerous fungi, is not lacking.—J. M. C.

J. W. TOUMEY has published the results of his study of "crown-gall" as Bulletin 33 from the Arizona Agricultural Experiment Station, under the title "An inquiry into the cause and nature of crown-gall." The name is applied to a disease which appears as fleshy outgrowths on the roots of deciduous fruit trees, usually at the crown. The author concludes that the cause is a specific organism, one of the Myxomycetes, parasitism among which has been thought to be confined to a single species (*Plasmodiophora brassicae*, which causes "club root" in cabbage and allied plants). The plasmodium and its effect upon the host cells are fully described, as well as the sporangia. The study of the organism is made the occasion of the establishment of a new genus, *Dendrophagus*.—J. M. C.

NOW THAT TRIPLE FUSION has been discovered in connection with the formation of the primary endosperm nucleus, illustrations are rapidly multiplying. First announced by Nawachsin for *Lilium Martagon*, it was confirmed for the same species by Guignard and Miss Sargant, the former adding other species of Lilium and also Fritillaria and Tulipa. Now Miss Ethel N. Thomas finds vermiform nuclei wrapped about the polar nucleus in *Caltha palustris*;[17] while Nawaschin has described and figured[18] triple fusion in the embryo-sacs of *Helianthus annuus*, *Rudbeckia speciosa*, and *Phaius Blumei* (an orchid).—J. M. C.

WARNSTORF gives[19] a description of the anatomical characters of a number of the species of Sphagnum which have not previously been examined with the thoroughness and minuteness which modern taxonomy demands in this group. The characters are drawn from types, and the examination of these has led to the reduction of many of the recently proposed species, particularly those of C. Müller, whose later work was so prolific of "new" species. Some of the critical remarks touch American and Antillean species. — C. R. B.

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[16] Jour. Linn. Soc. 34:438–448. *pls. 15–16.* 1900.

[17] Annals of Botany 14:318–319. 1900.

[18] Ber. d. Deutsch. bot. Gessell. 18:224–230. *pl. 9.* 1900.

[19] Bot. Cent. 82:7 sq. 1900.

VON DERSCHAU has studied carefully the process of wall thickening in the formation of the teeth of mosses.[20] He finds that preceding the true thickening process, the activity of the cytoplasm consists only of its preliminary accumulation on the membrane to be thickened. In this the nucleus exerts no clearly recognizable control, but does do so in the thickening process itself. This consists of the apposition of materials early produced in the cytoplasm, of which cellulose is the primary one, the other substances being such as promote hygroscopicity and resistance to decay.—C. R. B

DR. GEORG GOETZ has restudied the development of the egg in the Characeæ,[21] which leads him to consider the group as independent of the algæ and derived from the primitive type of the archegoniates, just as the mosses and ferns. The *Wendungszellen* of Nitella he regards as a reduced archegonium wall, and the peculiar separation of a portion of the nuclear substance reminds one of the formation of a ventral canal cell.—C. R. B.

DR. F. NOLL proposes[22] the use of the scape of dandelion for demonstrating the mechanics of tendril coiling. By cutting out from the scape a long strip not much wider than thick, and, after fastening the two ends so that they cannot rotate, immersing the preparation in water, the inner tissues elongate so greatly that the strip is thrown into a spiral coil with one or more points of reversal, thus imitating very closely a huge tendril.—C. R. B.

ACCORDING to Palladine,[23] though light is not requisite for the regeneration of proteids, if cane sugar is supplied to the etiolated leaves of *Vicia Faba* under experimental conditions, the regeneration goes on more energetically in light than in darkness, and for this the more refrangible light is the more efficient. Such leaves cultivated on cane sugar solution in light respire more than twice as actively as when kept in darkness.—C. R. B.

DR. OSCAR LOEW brings together a useful summary of the present knowledge of the physiological rôle of mineral salts.[24] Unfortunately the greater part of the earlier experimentation in this direction has been more or less misguided, and one must hold very loosely the conclusions reached. This summary, however, will be useful as a guide to the literature of the subject.—C. R. B.

[20] Bot. Cent. **82**: 161–168, 194–200. 1900.

[21] Inaug. Diss. Freiburg. 1899. See Bot. Cent. **81**: 366. 1900.

[22] Flora **86**: 388. 1899.

[23] Revue gén. de Bot. **11**: 81–105. 1899.

[24] LOEW, O.: "The physiological rôle of mineral nutrients." Bull. 18, U. S. Dept. Agric., Division of Veg. Physiol. and Path. 8vo, pp. 60. Washington: Gov. Printing Office, 1899.

OF GREAT INTEREST to all botanists is the report of Henry Gannett[25] on the forests of the United States. The author as chief of the Division of Geography and Forestry of the U. S. Geological Survey has had long and intimate acquaintance with the subject. It seems that on July 1, 1899, there were thirty-seven government forest reserves, aggregating 72,139 square miles, composed mainly of mountainous, rugged country, of no value for agriculture, but especially favorable for tree growth. The states containing these reserves are Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, South Dakota, Utah, Washington, and Wyoming. Of these Washington has much the largest proportion, 19 per cent. of the total area of the state being thus reserved. The bulk of the publication consists of abstracts of reports on forest reserves by special agents sent to examine them. —J. M. C.

TO THE LIST of seeds whose germination is affected by light, Heinricher adds our common *Veronica peregrina.*[26] Light, even weak light, accelerates germination, as a difference of five to eight days between light and dark cultures strikingly shows. The effect of the light depends apparently upon its action in promoting the digestion of the reserve foods.—C. R. B.

OSWALD RICHTER recommends[27] a concentrated solution of ammonia, used boiling, at 40° C., or cold, as a maceration fluid. He finds it much superior to the usual acids, because the cell wall is always intact. In many cases, also, the cell contents are preserved and even made clearer.—C. R. B.

PROFESSOR DR. S. ROSTOWZEW has devised,[28] apparently independently, the laboratory table with trapezoidal top, identical in form with that considerably used in this country when window space is scant. The form was first suggested, we believe, by Dr. C. E. Bessey.—C. R. B.

[25] Extract from Twentieth Ann. Rep. U. S. Geol. Surv., Part V, Forest Reserves. 1–37, with 7 maps. 1900.

[26] Ber. d. deutsch. bot. Gesells. **17**: 308. 1899.

[27] Oesterr. Bot. Zeitsch. **50**: 5–11. 1900.

[28] Bot. Cent. **81**: 361. 1900.